AMERICAN MEDICAL ASSOCIATION

APPRAISAL OF LOSS OF VISION

APPRAISAL OF LOSS OF VISUAL EFFICIENCY—STANDARD METHOD APPROVED BY THE HOUSE OF DELEGATES OF THE AMERICAN MEDICAL ASSOCIATION, ATLANTIC CITY, N. J., MAY 26, 1925

Extract from Proceedings of the House of Delegates

Dr. Cassius D. Wescott, Section on Ophthalmology, presented the report of the Committee on Compensation for Eye Injuries, adopted by the Section on Ophthalmology, together with a resolution providing for its adoption by the House of Delegates as follows:

Report of Committee on Compensation for Eye Injuries

The Committee on Compensation for Eye Injuries was appointed by the Section on Ophthalmology of the American Medical Association in 1919. It has submitted several reports. These have been accepted but not adopted, as more time was deemed necessary for further research. Herewith we submit a final report based on the results of our investigations, both experimental and clinical.

SCOPE

The aim of the committee is to establish a method of determining the loss of visual efficiency of a person who has suffered any degree of impairment of vision as the result of occupational disease, or injury. Such loss is to be the basis on which the amount of compensation shall be determined.

SECTION I. COMPENSATION BASED ON THE VISUAL EFFICIENCY OF THE INDIVIDUAL

Compensation for loss of vision should be that proportional part of the compensation provided by law for total permanent disability which expresses the percentage loss of visual efficiency of the individual in pursuing a gainful occupation.

Total permanent disability of both eyes is identical with total permanent disability of the individual.

It will be noted that this method of determining compensation makes unnecessary the separate provisions for computing compensation for disability of one eye and for disability of both eyes.

At present the compensation laws of most states contain provisions that base awards on disability of one eye only, and some statutes provide separate schedules for one eye and for both eyes. In the interest of uniformity, definiteness and

justice, it it is urged that compensation statutes be so changed that awards for ocular disability shall be based on the percentage of permanent disability only.

SECTION II. THREE PRIMARY AND COORDINATE FACTORS OF VISION

There are three elements of vision, each of which has an interdependent and coordinate relation to full visual efficiency. These coordinate factors are (*a*) acuteness of vision (central visual acuity); (*b*) field of vision, and (*c*) muscle function. Although these factors do not possess an equal degree of importance, no act of vision is perfect without the coordinate action of all.

Other functions, though secondary and dependent, are recognized as important, such as depth perception, stereoscopic vision, fusion sense, color perception, adaptation to light and dark, and accommodation. These functions are inherently dependent on the status of the three coordinating [redacted] of vision, and they also depend on central nervous [redacted]

SECTION III. MAXIMUM AND MINIMUM LIMI[redacted] THE PRIMARY COORDINATE FACTORS OF VISIO[redacted]

In order to determine the various degrees of visual efficiency, (A) normal or maximum, and (B) minimum limits for each coordinate function must be established; i. e., the 100 per cent point and the 0 per cent point.

A. *Maximum Limits.*—The maximum efficiency for each of these is established by existing and accepted standards.

(*a*) Central Visual Acuity: The ability to recognize letters or characters which subtend an angle of 5 minutes, each unit part of which subtends a 1 minute angle, is accepted as standard. Therefore, a 20/20 Snellen is employed as the maximum acuity of central vision, or 100 per cent acuity.

(*b*) Field Vision: A visual field having an area which extends from the point of fixation outward 65 degrees, down and out 65 degrees, down 55 degrees, down and in 45 degrees, inward 45 degrees, in and up 45 degrees, upward 45 degrees, and up and out 55 degrees is accepted as 100 per cent industrial visual field efficiency.

(*c*) Muscle Function: A maximum normal muscle function is present when there is absence of diplopia in all parts of the field of binocular fixation.

B. *Minimum Limits.*—The minimum limit, or the 0 per cent of the coordinate functions of vision, is established at that degree of efficiency which reduces vision to a state of uselessness.

(*a*) Central Visual Acuity: The minimum limit of this function is established as the loss of light perception, light perception being *qualitative* vision. The practical minimum limit of *quantitative* visual acuity is established as the ability to distinguish form. Experience, experiment and authoritative

opinion show 20/200 Snellen as 80 per cent loss of visual efficiency, 20/380 as 96 per cent loss, and 20/800 as 99.9 per cent loss. Table 1 and Chart 1 show the percentage loss of visual efficiency corresponding to the Snellen notations for distant and for near vision, for the measurable range of quantitative visual acuity.

(*b*) Field Vision: The minimum limit for this function is established as a concentric central contraction of the visual

TABLE 1.—*Percentage Loss of Visual Efficiency Corresponding to Snellen Notations for Distant and for Near Vision for Measurable Range of Quantitative Visual Acuity* *

Snellen Notation for Distance	Snellen Notation for Near	Percentage of Visual Efficiency	Percentage Loss of Vision
20/20	14/14	100.0	0.0
20/25	14/17.5	95.7	4.3
20/30	14/21	91.5	8.5
20/35	14/24.5	87.5	12.5
20/40	14/28	83.6	16.4
[illegible]/45	14/31.5	80.0	20.0
[illegible]/50	14/35	76.5	23.5
20/60	14/42	69.9	30.1
[illegible]/70	14/49	64.0	36.0
[illegible]	14/56	58.5	41.5
[illegible]	14/63	53.4	46.6
20/[illegible]	14/70	48.9	51.1
20/120	14/84	40.9	59.1
20/140	14/98	34.2	65.8
20/160	14/112	28.6	71.4
20/180	14/126	23.9	76.1
20/200	14/140	20.0	80.0
20/220	14/154	16.7	83.3
20/240	14/168	14.0	86.0
20/260	14/182	11.7	88.3
20/280	14/196	9.7	90.3
20/300	14/210	8.2	91.8
20/320	14/224	6.8	93.2
20/340	14/238	5.7	94.3
20/360	14/252	4.8	95.2
20/380	14/266	4.0	96.0
20/400	14/280	3.3	96.7
20/450	14/315	2.1	97.9
20/500	14/350	1.4	98.6
20/600	14/420	0.6	99.4
20/700	14/490	0.3	99.7
20/800	14/560	0.1	99.9

* For table for determining, with any of the common near vision test cards, the percentage loss of macular perception for the near test, see Supplementary Report of the Committee, page 10.

field to 5 degrees. This degree of contraction of the visual field reduces the visual efficiency to zero.

(*c*) Muscle Function: The minimum limit for this function is established by the presence of diplopia in all parts of the motor field. This condition constitutes zero visual efficiency.

SECTION IV. MEASUREMENT OF COORDINATE FACTORS AND THE COMPUTATION OF THEIR PARTIAL LOSS

A. *Central Visual Acuity.*—Visual acuity shall be measured both for distance and for near, using the Snellen notation,

each eye being measured separately. Central visual acuity for distance shall be measured at a test distance of 20 feet. Central visual acuity for near shall be measured at a test distance of 14 inches.

The quantity that determines the visual acuity efficiency of one eye shall be the result of the weighted values assigned to these two measurements for distance and for near. A onefold value is given to the former and a twofold value to the latter. Thus, if the visual efficiency for near is 40 per cent and the visual efficiency for distance is 70 per cent, the central visual acuity efficiency for the eye in question would be:

$$\frac{(40 \times 2) + (70 \times 1)}{3} = \frac{80 + 70}{3} = \frac{150}{3} = 50,$$

or a 50 per cent visual acuity efficiency.

The best central visual acuity obtainable *with correcting glasses* shall be used in determining the degree of visual efficiency.

If there exists a difference of more than 4 diopters of spherical correction between the two eyes, the best possible vision of the injured eye without glasses or with lenses of not more than 4 diopters spherical difference from the fellow eye shall be the acuity on which subsequent rating is to be computed for this injured eye.

The Snellen test letters or characters as published by the committee and designated "Industrial Vision Test Charts" subtend a 5 minute angle, and their component parts a 1 minute angle. These test letters are to be used at an examining distance of 20 feet for distant vision and 14 inches for near vision from the patient. The illumination is to be not less than three foot candles, nor more than ten foot candles on the surface of the chart.

Table 1 and Chart 1 show the visual acuity and the percentage of loss of efficiency, both for distance and for near, for partial loss between 100 per cent and zero vision for one eye.

B. *Field Vision.*—The extent of the field of vision shall be determined by the use of the usual perimetric test methods, a white target being employed which subtends a 1 degree angle under illumination of not less than three foot candles, and the result plotted on the industrial visual field chart.

The amount of radial contraction in the eight principal meridians shall be determined. The sum of these eight, divided by 420 (the sum of the eight principal radii of the industrial visual field) will give the *visual field efficiency of one eye in per cent.*

C. *Muscle Function.*—Muscle function shall be measured in all parts of the motor field, recognized methods being used for testing.

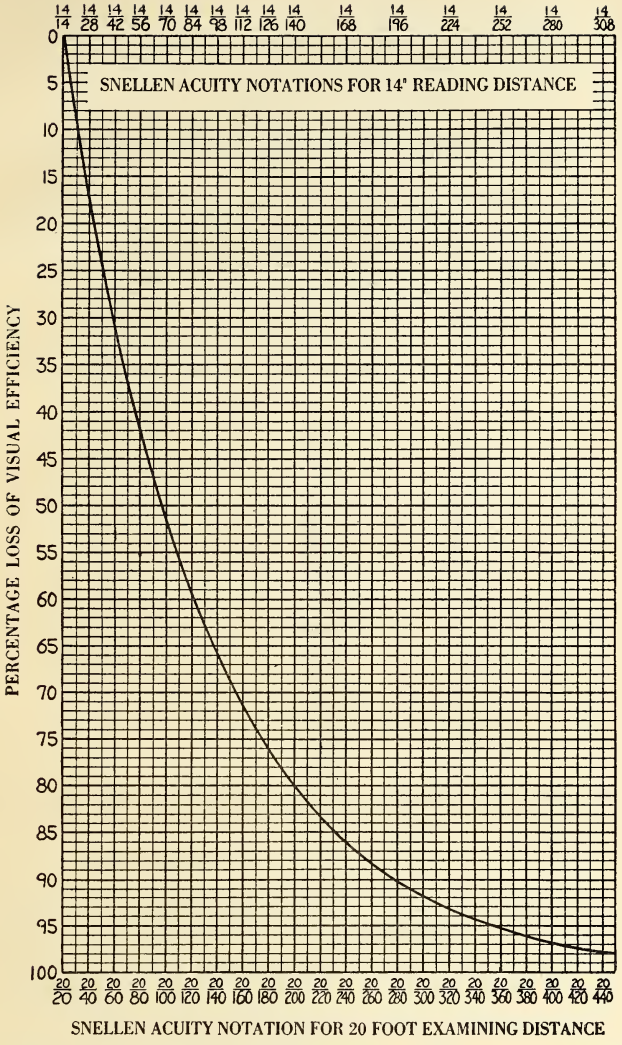

Chart 1.—Percentage loss of visual efficiency corresponding to the Snellen notations for distant and for near vision, for the measurable range of quantitative visual acuity.*

* For table for determining, with any of the common near vision test cards, the percentage loss of macular perception for the near test, see Supplementary Report of the Committee, page 10.

Diplopia may involve the field of binocular fixation entirely or partially. When diplopia is present, this shall be plotted on the industrial motor field chart. This chart is divided into twenty rectangles, 4 by 5 degrees in size. The partial loss to muscle function due to diplopia is that proportional area which shows diplopia as indicated on the plotted chart compared with the entire motor field area (Table 2 and Chart 4).

When diplopia involves the entire motor field, causing an irremediable diplopia, the loss in coordinate visual efficiency is equal to the loss of use of one eye; and when the diplopia is partial, the loss in visual efficiency shall be proportional and based on the efficiency factor value of one eye.

TABLE 2.—*Loss in Muscle Function*

No loss	equals	100%	Motor	Field	Efficiency
1/20	"	98%	"	"	"
2/20	"	95%	"	"	"
3/20	"	92%	"	"	"
4/20	"	89%	"	"	"
5/20	"	87%	"	"	"
6/20	"	84%	"	"	"
7/20	"	81%	"	"	"
8/20	"	77%	"	"	"
9/20	"	74%	"	"	"
10/20	"	71%	"	"	"
11/20	"	67%	"	"	"
12/20	"	63%	"	"	"
13/20	"	59%	"	"	"
14/20	"	55%	"	"	"
15/20	"	50%	"	"	"
16/20	"	45%	"	"	"
17/20	"	39%	"	"	"
18/20	"	32%	"	"	"
19/20	"	22%	"	"	"
20/20	"	0%	"	"	"

SECTION V. INDUSTRIAL VISUAL EFFICIENCY OF ONE EYE

The industrial visual efficiency of one eye is determined by obtaining the product of the computed coordinate efficiency values of central visual acuity, of field vision, and of muscle function. Thus, if central visual acuity efficiency is 40 per cent, visual field efficiency is 81 per cent and the muscle function efficiency is 100 per cent, the resultant visual efficiency of the eye will be $0.40 \times 0.81 \times 1.00 = 32.4$ per cent. Should diplopia be present in part of the motor field so that the motor efficiency is reduced 50 per cent, the visual efficiency would be $0.40 \times 0.81 \times 0.50 = 16.2$ per cent.

SECTION VI. INDUSTRIAL VISUAL EFFICIENCY OF THE INDIVIDUAL

It is a fact well established by common experience that the visual efficiency of the individual is by no means reduced to

one half (50 per cent) by the complete loss of one eye, vision in the fellow eye remaining normal. Hence the necessity for a weighted average. The researches of the committee show that a weighing factor of 3 applied to the more efficient eye gives an efficiency rating of the individual in substantial agreement with the consensus of technical judgment, such judgment being based on actual reproduction, comparison and relative evaluation of various specific conditions of visual efficiency.

The industrial efficiency of the individual is computed as follows: To the percentage figure which has been determined as the industrial visual efficiency of the *less* efficient of the two eyes, three times the percentage figure that has been

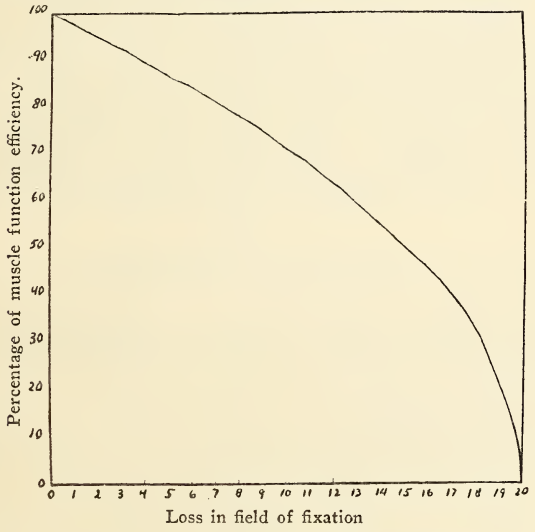

Chart 2.—Curve for loss of efficiency in diplopia.

determined similarly for the *more* efficient eye is added, and the result is divided by 4. The quotient will be the percentage figure that expresses the *industrial visual efficiency of the individual.* Thus, if the individual efficiency rating of the injured eye is 40 per cent and that of the fellow eye is 100 per cent, the visual efficiency of the individual will be found by the following formula:

$$\frac{(40 \times 1) + (100 \times 3)}{4} = \frac{340}{4} = 85 \text{ per cent}$$

Individual industrial efficiency, and compensation should be 15 per cent of the amount awarded for total permanent disability.

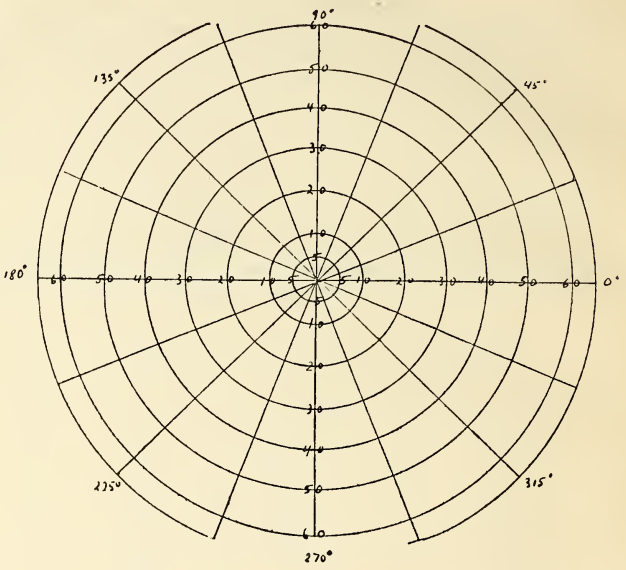

Chart 3.—Industrial visual field chart.

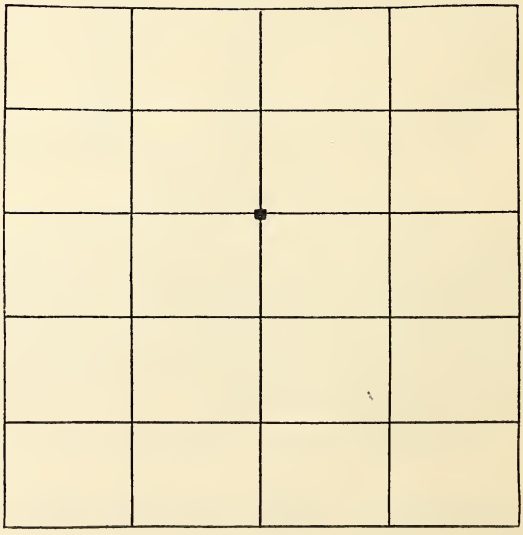

Chart 4.—Industrial motor field chart.

SECTION VII. TYPES OF OCULAR INJURY NOT INCLUDED IN THE DISTURBANCE OF THE COORDINATE FACTORS

Certain types of ocular disturbance are not included in the foregoing computations and these may result in disabilities, the value of which cannot be computed by any scale as yet scientifically possible of deduction. Such are disturbances of accommodation, of color vision, of adaptation to light and dark, metamorphopsia, entropion, ectropion, lagophthalmos, epiphora, and muscle disturbances not included under diplopia. For such disabilities additional compensation shall be awarded, but in no case shall such additional award make the total compensation for loss in industrial visual efficiency greater than that provided by law for total permanent disability.

Compensation for loss in industrial visual efficiency, as provided for above, does not include compensation for any cosmetic defect, for mental or physical suffering, for cost of medical attention, or for time lost from gainful occupation during the period of treatment previous to final computation of compensation as provided for below. Additional compensation should be awarded for the various losses here enumerated when not specifically provided for by statute.

SECTION VIII. REGULATIONS FOR COMPUTING COMPENSATION

Compensation shall not be computed until all adequate and reasonable operations and treatment known to medical science have been attempted to correct the defect. Further, before there shall be made the final examination on which compensation is to be computed, at least three months shall have elapsed after the last trace of visible inflammation has disappeared, except in cases of disturbance of extrinsic ocular muscles, optic nerve atrophy, sympathetic ophthalmia, and traumatic cataract; in such cases, at least twelve months and preferably not more than sixteen months shall intervene before the examination shall be made on which final compensation is to be computed.

In cases of additional loss in visual efficiency, when it is known that there was present a preexisting subnormal vision, compensation shall be based on the loss incurred as a result of eye injury or occupational condition specifically responsible for the additional loss. In case there exists no record or no adequate and positive evidence of preexisting subnormal vision, it shall be assumed that the visual efficiency prior to any injury was 100 per cent.

NELSON M. BLACK.
ALBERT C. SNELL.
JAMES PATTON.
HARRY S. GRADLE.

WHEREAS, The report of the Committee on Compensation for Eye Injuries, signed by Nelson M. Black, Albert C. Snell, James Patton and Harry S. Gradle, and published in the Presession Volume of the Section on Ophthalmology, has been unanimously adopted by the Section on Ophthalmology; therefore, be it

Resolved, That the House of Delegates endorse the said report on Compensation for Eye Injuries.

Dr. Wescott moved the adoption of the resolution. This motion was seconded by Dr. A. J. Bedell, New York, and carried.

Reprinted, except as to footnotes, from Proceedings of the House of Delegates of the American Medical Association, 1925

SUPPLEMENTARY REPORT OF THE COMMITTEE ON COMPENSATION FOR EYE INJURIES, ACCEPTED BY THE SECTION ON OPHTHALMOLOGY, MAY 20, 1927, BUT NOT SUBMITTED TO THE HOUSE OF DELEGATES

Extract from the Transactions of the Section on Ophthalmology

REPORT OF COMMITTEE ON COMPENSATION FOR EYE INJURIES

This committee has been continued for the purpose of giving the previously adopted report practical application. To carry out this purpose the committee has been active in giving assistance to many individuals, labor boards, and commissions.

The Ohio State Industrial Commission has made the provisions of the report the working basis for adjusting compensation in that state. Also, the report is being used by industrial boards in many other states, and it is being used very generally by ophthalmologists.

The committee has not been able to print a new and satisfactory near test card. Therefore we submit the following table, which gives approximately the corresponding size of letters, visual angle, and percentage of visual perception for the near test cards which are in ordinary use. With the use of this table a percentage loss of near vision may be determined with any of the common near vision test cards.

Table for Determining Percentage Loss of Macular Perception for the Near Test

Snellen Notations at 14 Inches A. M. A.	"Diopter" or Meter	Jaeger	Size in Mm. of Letters at 14 Inches	Visual Angle for All Notations	Corresponding Snellen Notations at 20 Feet	Percentage Central Visual Perception	Percentage Loss in Visual Efficiency
14/14	0.37 D.	No. 1	0.502	5	20/20	100.0	0
14/21	0.50 D.	No. 2	0.735	7.5	20/30	91.4	8.6
14/24	0.62 D.	No. 3	0.853	8.5	20/33	89.5	10.5
14/28	0.75 D.	No. 4	1.004	10	20/40	83.6	16.4
14/35	0.87 D.	No. 6	1.255	12.5	20/50	76.5	23.5
14/42	1.00 D.	No. 8	1.506	15	20/60	70.0	30.0
14/49	1.25 D.	No. 9	1.757	17.5	20/70	63.9	36.1
14/56	1.50 D.	No. 10	2.008	20	20/80	58.5	41.5
14/70	1.75 D.	No. 11	2.510	25	20/100	48.9	51.1
14/84	2.00 D.	No. 12	3.012	30	20/120	40.9	59.1
14/98	2.50 D.	No. 14	3.514	35	20/140	34.2	65.8
14/112	3.00 D.	No. 16	4.016	40	20/160	28.6	71.4
14/140	3.50 D.	No. 17	5.020	50	20/200	20.0	80.0
14/168	4.00 D.	No. 18	6.024	60	20/240	13.0	87.0
14/224	6.00 D.	No. 19	8.032	80	20/320	7.2	92.8
14/336	8.00 D.	No. 20	12.048	120	20/480	2.0	98.0

Nelson M. Black, Chairman.
Harry S. Gradle.
James Patton. *p. 370.*
Albert C. Snell.

Reprinted from Transactions of the Section on Ophthalmology, 1927